

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A membrane electrochemical generator, comprising:

a multiplicity of reaction cells,

each said reaction cell comprises an anodic chamber and a cathodic chamber separated by a proton exchange membrane,

each said reaction cell is delimited by a pair of conductive bipolar plates, so that one of said pair of conductive bipolar plate is adjacent to the anodic chamber and the other of said pair of conductive bipolar plate is adjacent to the cathodic chamber,

each of said pair of conductive bipolar plates comprises a first planar side and a second planar side on the reverse side of the first planar side, and

at least one of said pair of conductive bipolar plates comprises a multiplicity of fluid injection calibrated holes, wherein one end of the calibrated hole opens to a source of water on [[one]] the first planar side of said conductive bipolar plate and the other end of the calibrated hole opens to an adjacent chamber on the other second planar side of said conductive bipolar plate, so that the water flows from [[one]] the first planar side of the bipolar plate through the calibrated hole to the adjacent chamber,

said anodic chamber and said cathodic chamber each has an electrically conductive reticulated element,

wherein the reticulated element is a tridimensional network of wires that electrically connects the conductive bipolar plates to the electrode and distributes [[the]]

a flow of gaseous reactants in the anodic chamber or the cathodic chamber where the reticulate material resides,

said electrochemical generator further comprising a multiplicity of cooling cells,
each of the cooling cells being interposed between two reaction cells,

said cooling cell further comprising:

a perimetrical portion having a central hollow portion, side openings for the
passage of said cooling fluid, at least one fluid collection channel connected to said side
openings, feed openings for the passage of said flow of gaseous reactants, and
discharge openings or discharging the reaction products and residual reactants; and
an electrically conductive reticulated element residing in the central hollow
portion,

wherein a side channel fluidly connect the side opening with the hollow central
portion, and

wherein said cooling fluid traverses the cooling cell prior to crossing said fluid
injection holes into at least one adjacent reaction cell, pre-heating counter-currently or
concurrently with respect to at least one gaseous flow entering said reaction cells.

2. (Currently Amended) A generator of claim 1,

wherein said cooling fluid partially evaporated evaporates inside the reaction cell,
humidifying said flow of gaseous reactants inside the reaction cell and removing heat
generated in the reaction from said membrane electrochemical generator .

3. (Currently Amended) A generator of claim 1, wherein said fluid injection calibrated holes are mutually aligned and placed in correspondence of feed openings for the passage of said flow of gaseous reactants, and of side openings for the passage of said cooling fluid,

wherein said side openings are in a perimetrical portion of said conductive bipolar plates.

4. (Previously Presented) A generator of claim 1, wherein said fluid injection calibrated holes have the same diameter, said diameter is between 0.2 mm to 1 mm.

5. (Currently Amended) A generator of claim 1, wherein said conductive bipolar plates are interposed between an anodic sealing gasket and a cathodic sealing gasket from two adjacent reaction cells,

said sealing gaskets comprise:

a hollow center portion wherein an electrically conductive reticulated element resides,

feed openings for the passage of said flow of gaseous reactants;

side openings for the passage of said cooling fluid; and

distribution channels to fluidly connect said feed openings to said electrically conductive reticulated element.

6. (Previously presented) A generator of claim 5, wherein at least one of said sealing gaskets comprises fluid collection channels connected to said side openings,

said fluid collection channels are interposed between said feed openings and said distribution channels to collect said cooling fluid.

7. (Previously presented) A generator of claim 5, wherein at least one of said sealing gaskets comprises fluid collection channels connected to said side openings and to said distribution channels,

said fluid collection channels are located between said feed openings and said distribution channels.

8. (Previously presented) A generator of claim 6, wherein in a filter-press configuration said fluid collection channels present on at least one of the sealing gaskets are superposed to said fluid injection calibrated holes and that each of said fluid injection calibrated holes is in correspondence of a distribution channel obtained on the other sealing gasket.

9. (Cancelled)

10. (Currently Amended) A generator of claim [[9]] 1, wherein said fluid collection channel is located between said feed openings and said hollow central portion.

11. (Currently Amended) A generator of claim [[9]] 1, wherein in a filter-press configuration said fluid collection channel is superposed to said fluid injection calibrated holes of said conductive bipolar plates.

12 - 13. (Cancelled)

14. (Currently Amended) A membrane electrochemical generator, comprising:
a multiplicity of reaction cells,
each said reaction cell comprises an anodic chamber and a cathodic chamber
separated by a proton exchange membrane,
each said reaction cell is delimited by a pair of conductive bipolar plates, so that
one of said pair of conductive bipolar plate is adjacent to the anodic chamber and the
other of said pair of conductive bipolar plate is adjacent to the cathodic chamber,
each of said pair of conductive bipolar plates have a first planar side and a
second planar side on the reverse side of the first planar side, and
at least one of said pair of conductive bipolar plates comprises a multiplicity of
fluid injection calibrated holes, wherein one end of the calibrated hole opens to a source
of water on the first planar side of said conductive bipolar plate and the other end of the
calibrated hole opens to an adjacent chamber on the second planar side of said
conducting bipolar plate, so that the water flows from the first planar side of the bipolar
plate through the calibrated hole to the adjacent chamber,
said anodic chamber and said cathodic chamber each has an electrically
conducting reticulated element,

wherein the reticulated element is a tridimensional network of wires that
electrically connects the conductive bipolar plates to the electrode and distributes a flow
of gaseous reactants in the anodic chamber or the cathodic chamber where the
reticulate material resides,

A generator of claim 1, wherein said conductive bipolar plates comprise a multiplicity of first calibrated holes for the passage of said flow of gaseous reactants and a multiplicity of second calibrated holes for the discharge of reaction products and of optional residual reactants,

and that said multiplicity of fluid injection calibrated holes are placed in correspondence of said multiplicity of first calibrated holes[.].

said membrane electrochemical generator further comprises a multiplicity of
cooling cells, each of the cooling cells being interposed between two reaction cells and
comprising a rigid perimetrical portion and a hollow central portion, said rigid
perimetrical portion separates said flow of gaseous reactants from said hollow central
portion an electrically conductive reticulated element resides,

wherein said rigid perimetrical portion is covered on each face by a gasket, said
gasket defining on each face of said rigid perimetrical portion,

a zone for collecting said flow of gaseous reactants fluidly connects with said
feed openings of said rigid perimetrical portion through a feed channel, and
a zone for collecting the reaction products and the residual reactants fluidly
connects with said discharge openings of said rigid perimetrical portion through a
discharge channel,

wherein said fluid injection calibrated holes located between said feed openings
of said bipolar plates and said first calibrated holes, and
that said gasket defines on each face of said rigid perimetrical portion a fluid
collection channel located between said feed openings of said cooling cell and said
zone for collecting said flow of gaseous reactants.

15. (Previously Presented) A generator of claim 14, wherein said first calibrated holes are mutually aligned and placed in correspondence of feed openings of conductive bipolar plates, and that said second calibrated holes are mutually aligned and placed in correspondence of discharge openings on said perimetrical portion of said conductive bipolar plates.

16. (Previously Presented) A generator of claim 14, wherein said reaction cells comprise a sealing gasket covering only one face of said perimetrical portion of said conductive bipolar plates, said sealing gasket having a central hollow portion wherein an electrically conductive reticulated element resides.

17. (Cancelled)

18. (Currently Amended) A generator of claim [[17]] 14, wherein said rigid perimetrical portion has feed openings for feeding said flow of gaseous reactants, discharge openings for discharging the reaction products and the residual reactants, and side openings for the passage of said cooling fluid.

19. (Cancelled)

20. (Currently Amended) A generator of claim [[19]] 14 wherein said gasket seals said zone for collecting [[the]] said flow of gaseous reactants and said zone for collecting the reaction products and the residual reactants so as to hinder the passage of said flow of gaseous reactants and of said reaction products and optionally residual reactants within said cooling cell.

21. (Currently Amended) A generator of claim [[19]] 14, wherein in a filter-press configuration said zone for collecting [[the]] said flow of gaseous reactants is superposed to said first calibrated holes and said zone for collecting the reaction products and the residual reactants is superposed to said second calibrated holes.

22. (Currently Amended) A generator of claim [[19]] 14, wherein said fluid injection calibrated holes are located below said first calibrated holes and that said gasket defines on each face of said rigid perimetrical portion a fluid collection channel placed below said feed openings of said cooling cells.

23. (Cancelled)

24. (Currently Amended) A generator of claim 22, wherein in a filter-press configuration said fluid collection channel is superposed to said fluid injection calibrated holes.

25. (Currently Amended) A membrane electrochemical generator, comprising:
a multiplicity of reaction cells,
each said reaction cell comprises an anodic chamber and a cathodic chamber
separated by a proton exchange membrane,
each said reaction cell is delimited by a pair of conductive bipolar plates, so that
one of said pair of conductive bipolar plate is adjacent to the anodic chamber and the
other of said pair of conductive bipolar plate is adjacent to the cathodic chamber,
each of said pair of conductive bipolar plates have a first planar side and a
second planar side on the reverse side of the first planar side, and
at least one of said pair of conductive bipolar plates comprises a multiplicity of
fluid injection calibrated holes, wherein one end of the calibrated hole opens to a source
of water on the first planar side of said conductive bipolar plate and the other end of the
calibrated hole opens to an adjacent chamber on the second planar side of said
conducting bipolar plate, so that the water flows from the first planar side of the bipolar
plate through the calibrated hole to the adjacent chamber,
said anodic chamber and said cathodic chamber each has an electrically
conductive reticulated element,
wherein the reticulated element is a tridimensional network of wires that
electrically connects the conductive bipolar plates to the electrode and distributes a flow
of gaseous reactants in the anodic chamber or the cathodic chamber where the
reticulate material resides,
wherein said conductive bipolar plates comprise a multiplicity of first calibrated
holes for the passage of said flow of gaseous reactants and a multiplicity of second

calibrated holes for the discharge of reaction products and of optional residual reactants,

and that said multiplicity of fluid injection calibrated holes are placed in correspondence of said multiplicity of first calibrated holes,

said membrane electrochemical generator further comprises a multiplicity of cooling cells, each of the cooling cells being interposed between two reaction cells and comprising a rigid perimetrical portion and a hollow central portion, said rigid perimetrical portion separates said flow of gaseous reactants from said hollow central portion an electrically conductive reticulated element resides,

wherein said rigid perimetrical portion is covered on each face by a gasket, said gasket defining on each face of said rigid perimetrical portion,

a zone for collecting said flow of gaseous reactants fluidly connects with said feed openings

of said rigid perimetrical portion through a feed channel, and a zone for collecting the reaction products and the residual reactants fluidly connects with said discharge openings of said rigid perimetrical portion through a discharge channel,

A generator of claim 19, wherein said cooling cells comprise a first and a second fluid collection lateral channel connected to said side openings of said cooling cells and placed above said discharge openings of said cooling cells, and

that said cooling fluid, prior to reaching said fluid injection holes, passes through said first and second fluid collection lateral channels to cross subsequently the whole

surface of said electrically conductive reticulated element, pre-heating counter-currently or concurrently with respect to at least one gaseous flow entering said reaction cells.

26. (Currently Amended) A membrane electrochemical generator, comprising:
a multiplicity of reaction cells,
each said reaction cell comprises an anodic chamber and a cathodic chamber
separated by a proton exchange membrane,
each said reaction cell is delimited by a pair of conductive bipolar plates, so that
one of said pair of conductive bipolar plate is adjacent to the anodic chamber and the
other of said pair of conductive bipolar plate is adjacent to the cathodic chamber.
each of said pair of conductive bipolar plates have a first planar side and a
second planar side on the reverse side of the first planar side, and
at least one of said pair of conductive bipolar plates comprises a multiplicity of
fluid injection calibrated holes, wherein one end of the calibrated hole opens to a source
of water on the first planar side of said conductive bipolar plate and the other end of the
calibrated hole opens to an adjacent chamber on the second planar side of said
conductive bipolar plate, so that the water flows from the first planar side of the bipolar
plate through the calibrated hole to the adjacent chamber,
said anodic chamber and said cathodic chamber each has an electrically
conductive reticulated element,
wherein the reticulated element is a tridimensional network of wires that
electrically connects the conductive bipolar plates to the electrode and distributes a flow

of gaseous reactants in the anodic chamber or the cathodic chamber where the reticulate material resides,

wherein said conductive bipolar plates comprise a multiplicity of first calibrated holes for the passage of said flow of gaseous reactants and a multiplicity of second calibrated holes for the discharge of reaction products and of optional residual reactants,

and that said multiplicity of fluid injection calibrated holes are placed in correspondence of said multiplicity of first calibrated holes,

said membrane electrochemical generator further comprises a multiplicity of cooling cells, each of the cooling cells being interposed between two reaction cells and comprising a rigid perimetrical portion and a hollow central portion, said rigid perimetrical portion separates said flow of gaseous reactants from said hollow central portion an electrically conductive reticulated element resides,

wherein said rigid perimetrical portion is covered on each face by a gasket, said gasket defining on each face of said rigid perimetrical portion,

a zone for collecting said flow of gaseous reactants fluidly connects with said feed openings

of said rigid perimetrical portion through a feed channel, and a zone for collecting the reaction products and the residual reactants fluidly connects with said discharge openings of said rigid perimetrical portion through a discharge channel,

A generator of claim 19, wherein said cooling cells comprise:

a first and a second fluid collection lateral channel connected to said side openings of said of said cooling cells and placed above said discharge openings of said additional cells;

a third and a fourth fluid collection lateral channel connected to said side openings of said cooling cells and placed below said feed openings of said cooling cells; a fluid collection channel located between said feed openings of said cooling cells and said zone for collecting [[the]] said flow of gaseous reactants and connected to said side openings of said cooling cells;

said cooling fluid, prior to reaching said fluid injection holes enters through said first and second fluid collection lateral channel to subsequently cross the whole surface of said electrically conductive reticulated element, pre-heating counter-currently or concurrently with respect to at least one gaseous flow entering said reaction cells, wherein said cooling fluid subsequently exiting from said third and fourth fluid collection lateral channel; and

in a filter-press configuration said fluid collection channel is superposed to said fluid injection calibrated holes.

27. (Previously Presented) A generator of claim 1, wherein said cooling fluid is liquid water.

28. (Canceled)